REMARKS

Claims 1-27 are all the claims pending in the application. No claims are amended or cancelled.

Declaration of Mikiko IKENISHI

Applicants are submitting a Declaration of Mikiko Ikenishi, an inventor in the present application, that addresses the points made by the Examiner in framing the rejection, including the assumptions made with regard to (1) the technical disclosure of each of the three cited prior art references, including the composition of the glass disclosed in each reference, (2) the knowledge of one skilled in the relevant art of optical glass manufacturing, and (3) the specific parameters of at least ***viscosity*** and ***liquidus temperature*** as they affect glass compositions, according to the knowledge of one skilled in the art.

Claim Rejections- 35 USC 103

Claims 1 (linking), 5, 11-14 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashimoto et al (US 6332338) and Hayashi et al (US 5900296) taken with Maeda et al (US 6297182 — newly applied). This rejection is traversed for at least the following reasons.

Hashimoto et al

In framing the rejection, the Examiner identifies text in Hashimoto et al that relates to much of the claimed glass composition, but admits that

> *"Hashimoto et al does not teach the addition of BaO and Zro_2 in the glass. However the addition of BaO and ZrO_2 to glass is a convention well known in the glass substrate from Hayashi et al. BaO is a conventional additive controlling vitrification levels through regulating Tg levels with ZrO_2 added offset BaO content to maintain substrate durability and hardness levels as Tg is varied. Hayashi et al teaches adding small addition of BaO and ZrO_2, in instantly claimed content, optimally offsetting the CaO content for a CaO to total SrO, ZnO and TiO_2 within what has been claimed (Hayashi et al col. 2 In 4 to col. 3 In 4-10 — particularly at col. 2 Ins 38-39, 46-47) with applicants' SrO, ZnO and TiO_2 content at zero to 15, at zero to 10 and at zero to 10 respectively.*
>
> *The claims have been amended to comprise no Li_2O.*

Hayashi et al shows a preference for low Li_2O (Hayashi et al col. 3 In 22 and 23) and Maeda et al shows an optimal Tg by having no having Li_2O (Maeda et al col. 4 Ins 33,34 with all examples of glass comprise no Li_2O noting examples 1, 2, 3 and 6 in Table 1 col. 5 and 6 with specific examples of glass comprised of no Li_2O, compensated with components for optimal strength and maintaining low Tg for improved manufacture). These specific consistent with Hashimoto et al or Hayashi et al content [CaO : total CaO+MgO+SrO+BaO] less than or = 0.5 and a total CaO+MgO+SrO+BaO+ZnO between 3-30%.

It would have been obvious to one of ordinary skill in the art to adopt either of Hayashi et al addition of BaO and ZrO_2 with the Maeda et al absence of Li_2O in the Hashimoto et al glass for optimal Tg for improvements in working the glass while maintaining high substrate durability (Hayashi et al col. 5 Ins 56- 64 and Maeda et al col. 1 Ins 6, 7 and improved Tg levels demonstrated in specific examples 1, 2, 3 and 6 of Table 1). [emphasis added]

In the reproduced conclusion reached by the Examiner, the stated assumption is that either of Hayashi combined with Hashimoto or Maeda combined with Hashimoto would have been obvious. However, as demonstrated by the accompanying declaration of Mikiko Ikenishi, neither combination would have been obvious to one skilled in the art when the complete teachings of each reference is considered. In fact, one skilled in the art would find the references teaching away from their combination.

1. No Basis for a Combination of Hashimoto and Hayashi

Specifically, Ikenishi demonstrates that "a person skilled in the substrate glass making art would not combine Hayashi with Hashimoto since (i) the major components of Hayashi's glass differ from major components of Hashimoto's glass, (ii) the substrate manufacturing process in Hayashi (a "**float process**") is completely different from the substrate manufacturing processes in Hashimoto (a "**press shaping**" method and a "**re-heat pressing**" method, and (iii) the composition of Hayashi's glass that is suitable for the **"float process"** method is a totally different composition from the composition of glass suitable for the **press shaping** method and **re-heat pressing** method utilized in Hashimoto.

i) Hashimoto's glass

Composition: comprises TiO_2 and 35-65 mol% of SiO_2

The major characteristic (non-SiO_2) component of Hashimoto's glass is TiO_2, as taught at col. 5, lines 45 – 55 of the original specification:

> *In the composition of a glass (this glass will be referred to as "glass for a substrate" hereinafter) to be obtained from the above molten glass, TiO2 is a component suitable for obtaining a glass substrate having a high Young's modulus, and the content thereof is required to be at least 0.1 mol % for obtaining a glass substrate having a Young's modulus of at lest 90 GPa. When the content thereof exceeds 30 mol %, however, the devitrification resistance of the glass decreases, so that it is difficult to obtain a glass for a substrate having* ***a liquidus temperature*** *of 1,360° C or lower.*

All of the Examples 1 – 99 in Hashimoto comprise TiO_2 (see Tables 1 to 14).

The amount of SiO_2 of Hashimoto's glass is 35-65 mol%, as taught at col. 6, L 45 – 53 of the original specification:

> *SiO2 is a component for forming a glass network, and the content thereof is required to be at least 35 mol % for obtaining a glass having a liquidus temperature of 1,360 °C or lower. However, when the content thereof exceeds 65 mol %, it is difficult to obtain a glass substrate having a Young's modulus of at least 90 GPa. SiO2 is a component having an influence on the water resistance such as diffusion of alkali ion, and it is effective when the content thereof is 40 to 60 mol %.*

Manufacturing process: comprises only a press shaping method or a re-heat pressing method

Hashimoto teaches two methods of manufacturing a glass substrate. One is a press shaping method or a direct press method **(Process I)** and the other is a re-heat pressing method **(Process II).**

Process I – the process is taught at col. 5, L 21 – 39, wherein both ***viscosity*** and ***liquidus temperature*** are relevant parameters, as follows:

> *The above Process I, one of the processes for the production of a glass substrate for an information recording medium (to be sometimes simply referred to as "glass substrate" hereinafter), is a process in which a molten glass is direct-press-shaped with an upper mold member and a lower mold member of a mold, and as the above molten glass, there is used a glass which contains 0.1 to 30 mol % of TiO2, 1 to 45 mol % of CaO, 5 to 40 mol % of total of MgO and the above CaO, 3 to 30 mol % of total of Na2O and Li2O, 0 to 15 mol % of Al2O3 and 35 to 65 mol % of SiO2 and has properties of* ***a liquidus temperature of 1,360 °C or lower*** *and* ***a viscosity of at least 10 poise in a shaping-allowable temperature range****. The mold has an upper mold*

member and a lower mold member, or it has an upper mold member, a lower mold member and a sleeve. The material for the mold is selected from cast iron, graphite, an Ni-containing alloy and a tungsten alloy. A release agent such as a boron nitride is applied to a shaping surface of the mold.

Liquidus temperature, see col. 4, lines 7-12

*Further, **a press shaping method** in which a production cost is relatively low is widely employed for shaping a glass into the form of a disc, and for preventing an adverse influence on a mold in the above method, it is preferred to maintain a **liquidus temperature** at 1,360 ^{o}C or lower.*

Viscosity, see col. 7, lines 48-62

*Further, even if the **liquidus temperature** of the glass for a substrate is 1,360 ^{o}C or lower, but when the viscosity in a temperature range in which the glass for a substrate is shapeable (which temperature range means a temperature range at which the glass for a substrate is shapeable by direct press shaping, and used in this sense hereinafter), i.e., the **viscosity** in a temperature range including and higher than the **liquidus temperature** is extremely low, not only it is difficult to control the flow rate of a glass melt (molten glass) when the glass melt is supplied to a shaping step in the course of obtaining a glass substrate, but also the degree of freedom of a shapeable form decreases. <u>The above **viscosity** of the molten glass used in Process I is at least 10 poise, preferably at least 30 poise. The upper limit thereof is 500 poise or less in view of stability in shape during the shaping</u>.*

Combination of Liquidus Temperature and Viscosity, see col. 7, lines 48-62

*For obtaining a glass substrate by Process I, it is required to prevent the substantial precipitation of a crystal during its production process. That is because, if a glass is devitrified, glass material components are precipitated, and impurities remain in a formed glass and deteriorate the surface smoothness of the glass substrate surface. It is therefore preferred <u>to carry out the steps of melting glass raw materials, shaping and cooling, at a temperature equivalent to, or higher than, a temperature around the liquidus temperature of the glass when a glass substrate is produced</u>. Since, however, the above **liquidus temperature** is extremely high, a mold undergoes deformation (around 1,400 ^{o}C) when a direct press shaping is carried out, so that the production of the glass substrate is difficult itself and that it does not have practical utility any longer. It is therefore preferred to feed a molten glass to a mold through an outlet of a nozzle <u>at a temperature which is within a temperature range corresponding to a glass **viscosity** of 10 to 500 poise and which is equivalent to, or higher than, a temperature around the **liquidus temperature**.</u> Practically, a temperature which is -20 ^{o}C below the **liquidus temperature** may be sufficient so long as no crystallization takes place.*

In a press shaping method of the Hashimoto's process, there is a reference to a relation between the **liquidus temperature** and the glass **viscosity**, but there is no strict requirement with respect to a relation between the **liquidus temperature** and the glass **viscosity**.

Process II - the process is taught at col. col. 9, line 66 to col. 10, line 28, wherein <u>only **viscosity** is a critical parameter</u>, as follows:

> *Process II of the present invention comprises providing a preform formed of a glass having the same composition as that of the "glass for a substrate" referred to in the above Process I of the present invention and shaping the preform into a disc form by a re-heat pressing method, to obtain a glass substrate for an information recording medium.*
>
> *The glass or molten glass for use as a material for the preform preferably has the composition which is the same as the composition preferred in the above Process I of the present invention.*
>
> *The method of producing an intended preform is not specially limited, and it may be any one of hot processing and cold processing methods. Further, the form of the preform is not specially limited, either, and it may have any desired form of a sphere, a prism, a plate, and the like. After a preform is formed in a desired form by hot processing or cold processing, the preform may be polished.*
>
> *A preform can be re-heat pressed by providing a mold having a cavity having the form of a desired disc (a mold formed of an upper mold member and a lower mold member or a mold formed of an upper mold member, a lower mold member and a sleeve), <u>either pre-heating the preform so as to allow the preform to have a **viscosity** of approximately 10^7 to 10^2 poise and placing it in the above mold, or placing the preform in the above mold and heating it together with the mold so as to allow the preform to have a **viscosity** of 10^7 to 10^2 poise, and then press-shaping the preform under a shaping pressure of approximately 10 to 300 kgf/cm^2 for approximately 0.1 to 600 seconds.</u> The shaping surface of the mold is generally provided with a release film, as is done in re-heat press shaping of a glass for other use.*

In the **re-heat pressing method** of Hashimoto, it is not necessary to consider the ***liquidus temperature*** because the preform is not heated to temperature as high as a temperature for melting the glass.

<u>**Float Process**</u> - There is <u>no teaching</u> of a float process in Hashimoto. Moreover, the ***liquidus temperature*** of Hashimoto's glass is 1360°C or lower, preferably 1250°C or lower, more preferably 1150°C or lower**.** The glass ***viscosity*** at around the ***liquidus temperature*** of

Hashimoto's glass is 10 to 500 poise. Glass in such a range of viscosity is not suitable to use in the "float process," as discussed later.

ii) Hayashi' s glass

Composition: comprises ***no*** TiO_2 and ***more than*** 65 mol% of SiO_2 - see Table A below from Hayashi:

Table A

mol% Hayashi(US 5,900,296)

	1	2	3	4	5
SiO_2	**66.73**	**65.99**	**70.73**	**67.29**	**71.52**
Al_2O_3	4.75	5.15	5.29	4.17	0.87
Na_2O	4.69	3.41	6.53	5.72	12.91
K_2O	4.63	6.01	2.87	5.27	0.31
MgO	3.43	6.94	0.84	1.76	5.89
CaO	5.92	3.16	7.22	5.06	8.46
SrO	4.61	6.13	2.61	3.42	0
BaO	3.57	2.32	3.09	5.56	0
ZrO_2	1.63	0.89	0.82	1.73	0
Fe_2O_3	0.04	0	0	0.02	0.04
Total	100.00	100.00	100.00	100.00	100.00

Manufacturing process: comprises only the **"float process"** or **"Pilkington process"**

"Float process"

The Hayashi substrate is produced by making a glass plate using a "float process" and then cutting the glass plate into disk shapes. Basic information on the "float process" is provided in U.S. Patent 2,911,759 to Pilkington et al. and U.S. Patent 5,958,812 for S. Koch et al (Saint-Gobain Vitrage))

According to Pilkington et al, in the "float process" molten glass is expanded on a molten metal such as tin by pulling the molten metal to obtain a glass sheet. In this case, low ***viscosity*** (high temperature) ***inhibits*** pulling and expanding the molten glass. In contrast, high ***viscosity*** (low temperature) ***allows*** pulling and expanding but increases the possibility of loss of transparency due to devitrification of the molten glass.

Low ***Liquidus Temperature*** - In the manufacture of glass according to the **"float process,"** an improvement of the resistance to loss of transparency (devitrification resistance) and lowering of the ***liquidus temperature*** is required.

According to Koch et al at col. 3, lines 52-56, the ***liquidus temperature*** must be less than the temperature exhibiting glass ***viscosity*** of $10^{3.5}$ poise:

> *In float glass technology, in particular, it is important for the* ***liquidus temperature*** *of the glass to remain equal to or lower than the temperature corresponding to* $\log\eta=3.5$*, which is the case with the glasses according to this invention.*

iii) Clear Teaching Away From a Combination of Hayashi with Hashimoto

Ikenishi concludes that "a person of ordinary skill in the art of glass substrate manufacture would know that a simple application of a part of the composition of **Hayashi's glass** to **Hashimoto's glass** is to be avoided because of the different requirements for ***liquidus temperature***. As detailed above, the two patents teach in opposite directions. **Hashimoto's glass** is one suitable for manufacturing a glass substrate by a press shaping method and a re-heat pressing method, at least in one method ***liquidus temperature*** being critical, but **Hashimoto's glass** is not one suitable for manufacturing a glass substrate by **"float process"**. In contrast, **Hayashi' s glass** is designed to be suitable for manufacturing **a glass sheet** by a **"float process"** that is not always or usually suitable for manufacturing in a press shaping method and a re-heat pressing method." (emphasis added)

2. No Basis For a Combination of Maeda with Hashimoto

Ikenishi further concludes that "a person skilled in the substrate glass making art would not combine Maeda with Hashimoto since (i) the major components of Maeda's glass differ from major components of Hashimoto's glass and (ii) the composition of Maeda's glass that is suitable for the "float process" method is a totally different process from the composition of glass

suitable for the press shaping method and re-heat pressing method utilized in Hashimoto," specifically because of differences in the glass compositions and manufacturing process used.

i) Maeda's glass

Composition: comprises B_2O_3, ***more than*** 65 mol% of SiO_2, and ***no*** TiO_2

The major component of Maeda's glass is SiO_2 and comprises more than 65 mol% of SiO_2 like Hayashi. Also, Maeda's glass comprises B_2O_3 in addition to SiO_2 and Al_2O_3, as an essential component.

Example 14 in Maeda, which glass does not comprises B_2O_3, is only a comparative example and Maeda teaches that the fracture toughness of this glass is lower than those of working examples and the resistance against the progress of fracture is low, whereby the probability of breakage during the production process of during the use, is high (see col. 6, lines 30-33). The glass of Example 14 does not comprise Li_2O.

Thus, a person of ordinary skill in the art, reading the teachings of Maeda, would understand that for a glass that does not comprise B_2O_3, it would not be desirable to exclude Li_2O. In other words, Li_2O is desired, according to the overall teachings of Maeda.

Further, a person of ordinary skill in the art would note that Hashimoto's glass does not comprise B_2O_3.

Thus, in view of the foregoing teachings of **Maeda**, an exclusion of Li_2O from the **Hashimoto's glass** that does not comprise B_2O_3 is not desired since **Maeda** teaches that exclusion of Li_2O from a glass not comprising B_2O_3 results in lower fracture toughness. This means that the resulted glass is unsuitable to a glass substrate for information recording medium. **Maeda** teaches away from the present invention in a case of combination of **Hashimoto** with **Maeda.**

In addition, the glasses disclosed in **Maeda** do not comprise TiO_2 like **Hayashi's glass.**

SiO_2 content (mol%) of the glass of Example 14 is 66.15 mol% (see table below) which is out of the SiO_2 content range of **Hashimoto's glass**, 35 to 65mol%.

mol% Maeda (US 6,297,182)

	1	2	3	4	5	6	7	8

SiO_2	57.02	56.9	57.05	56.87	56.99	57.01	56.98	66.07
Al_2O_3	10.97	12.03	9.48	9.02	9.48	9.48	9.8	6.83
B_2O_3	3.99	4.03	4.04	4	4	4.5	4.21	2.37
MgO	6.58	5.99	6.48	6.57	6.58	5.96	5.95	7.07
CaO	10.95	10.47	10.95	10.03	9.45	9.03	9.5	6.77
SrO	0	0	0	1.02	1.47	1.99	1.48	0
BaO	0	0	0	0	0	0	0	0
ZrO_2	0	0	1.48	1.99	1.51	1.52	1.51	0
Na_2O	6.99	7.05	6.01	5.02	5.24	5.27	5.05	5.92
K_2O	3.5	3.53	4.51	5.48	5.28	5.24	5.52	4.97
Li_2O	0	0	0	0	0	0	0	0
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	9	10	11	12	13	**14**	15
SiO_2	64.06	63.96	58.83	60.78	63.68	**66.16**	65.31
Al_2O_3	7.17	7	8.52	5.49	5.02	8.06	8.55
B_2O_3	4.37	4.67	4.1	4.17	1.04	0	0
MgO	5.46	7.25	5.27	6.05	6.03	3.4	0
CaO	6.34	2.32	9.46	9.52	6.9	6.11	0
SrO	1.5	2.51	1.79	1.97	3.49	1.32	0
BaO	0	0	0	0	0	2.69	0
ZrO_2	0	0	1.51	1.98	2.88	1.11	3.54
Na_2O	5.95	7.12	5.03	2.55	6.99	4.97	10.05
K_2O	5.15	5.17	5.49	7.49	3.97	6.18	0
Li_2O	0	0	0	0	0	**0**	12.55
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Manufacturing process: comprises only the **"float process"** or **"Pilkington process"**

As stated in Maeda at col. 2, lines 39 and 40, the process used is a float process.

ii) Combination of Maeda with Hashimoto

First, a person skilled in the glass substrate manufacturing art would understand that the use of low Li_2O and no Li_2O are very different concepts with significantly different results. Second, since the basic composition of **Maeda's glass** is different from the basic composition of **Hashimoto's glass** in (1) TiO_2 content (the presence or absence) and (2) SiO_2 content (mol%), it

would not be obvious for those skilled in the art to simply adopt a part of the composition of **Maeda's glass** to **Hashimoto's glass** without considering the impact on the glass, the manufacturing process and the parameters involved, and the need for added modification due to the complex interplay between these variables.

3. No Motivation To Combine The Three References

In supporting the obviousness of the selected extraction of teachings from Hayashi and Maeda to modify Hashimoto, the Examiner has stated that:

> *It would have been obvious to one of ordinary skill in the art to adopt either of* ***Hayashi et al*** *addition of BaO and* ZrO_2 *with the* ***Maeda et al*** *absence of* Li_2O *in the* ***Hashimoto et al*** *glass for optimal Tg for improvements in working the glass while maintaining high substrate durability*

Ikenishi disagrees with the stated logic since one skilled in the art would also consider the other components and compounds in the glass of Hashimoto, the different processes utilized to make a glass disk and the different parameters of those processes, particularly the temperatures and viscosities involved. One skilled in the art would not be led to make the adjustments and modifications made by the Examiner and, in fact, would be led away from such combination. Indeed, Ikenishi concludes that "one skilled in the art fully considering the teachings of each of Hashimoto, Hayashi and Maeda would find significant incompatibilities that would preclude consideration of the combination of selected teachings from each reference. and would find the Examiner's rationale for adding selected teachings to be overwhelmed by the reasons not to combine.

Claims 6-10, 15 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hashimoto et al and Hayashi et al taken with Maeda et al as applied to claims 1,5, 11-14 and 19-21 above, and further in view of Ikenishi et al (US 2003/0109370).

Ikenishi et al is cited for a teaching of a chemically reinforced recording medium substrates that are heated to reinforcing levels claimed, (Ikenishi et al ¶[0073]). Ikenishi does not provide the bridging teachings that would have led one skilled in the art to combine the teachings of Hashimoto et al with Hayashi et al and Maeda et al, against the incompatibilities noted in the Ikenishi declaration and asserted above.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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